NATIONAL ENDOWMENT FOR THE HUMANITIES

SAMPLE APPLICATION NARRATIVE

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Digital Humanities Start-Up Grants (Level II)
Institution: Drew University

Sample Application

Program: Digital Humanities Start-Up Grants

Note: The attached sample application was awarded a grant during a previous competition. Note that resumes, letters of support, coversheets, and other pieces of the application that contain personal contact information have been removed.

1. Table of contents

3. Abstract

Digital Mappaemundi (DM) is designed to enable scholars to edit networks of text *and* image data, and users to search within and link between these documents. Our data are medieval *mappaemundi* ("maps of the world") and their geographical source texts. These transdisciplinary, transmedia works provide a perfect basis for development of an extensible, open source tool useful for other humanities projects. *DM* provides new interactions within maps and texts through an interface in which these documents can be examined individually and relationally, *i.e.*, as a database of documents searchable for points of origin, correlation and difference. Users search across edited items for specific details, and results take users to exact spots on maps and in literature, and create cross-referenced lists of comparable material across items searched. *DM* develops extensible markup language (XML) tags to easily edit data to points in images and texts, so all documents can be linked through shared content.

4: Narrative
Digital Mappaemundi: Enhancing the humanities through the use of emerging technologies
Digital Mappaemundi (DM) proposes an extensible, collaborative model of open source scholarship, one that allows scholars to collaboratively contribute to and edit associated networks of image and text data, and users to search and organize this material in ways impossible before. As such, this work should prove applicable and valuable far beyond its initial scope of study. To develop such a new architecture, this project will focus on medieval *mappaemundi* ("maps of the world") and the geographic texts on which they were based. The transdisciplinary nature of these maps and texts provide (following the argument of the *ACLS Cyberinfrastructure Report*) a perfect basis for the development of a cooperative and open source tool well-suited for adaptation and use for other humanities projects. To accomplish this goal, we have assembled a team of experts from an array of disciplines, with contributing specialists in History, Art History, Literature, History of Cartography and Computer Science. Our goal is to provide not only a rich collection of cartographic data but, more importantly, a new method of engagement with this data. We are using our material as a proving ground for our extensible technology that will eventually extend far beyond the scope of this first application. Given their inherently transdisciplinary nature, medieval maps offer a perfect basis for such a project. As hybrid documents, neither text nor image, these maps present challenges to traditional, text-based models of digitization and searchability.

Medieval maps of the world, produced by monks who had taken vows not to travel, were not designed for navigation. Consequently scientific accuracy, the foundation of modern cartography, was irrelevant. Rather, medieval maps were aimed at helping their largely monastic audience understand their place in the world. And despite their "lack" of scientific accuracy—only lacking if this was their function—these maps were highly influential, well into the Renaissance and beyond.

Many geospatial projects are currently underway in the humanties that strive to plot historical locations, texts, art and/or events onto existing maps or satellite-produced maps of the globe. These projects (for examples, see **Environmental Scan**) are primarily designed to connect historical/cultural data to the "real" world as geo-, topo- or cartographically plotted. While these projects bring much to the study of their subjects, medieval maps do not function like modern maps. They are far more similar to literature or art, in that they are representations that are not necessarily grounded in the specifics of our reality. They were not designed to correspond with the globe, point for point. Rather, they are based on a complex, referential network of texts and other maps. Indeed, while we call these objects maps, the medieval term was *mappae*, a word meaning "cloths" or "coverings," not "maps." Consequently, efforts to match their contents consistently with our post-Enlightenment, observation-based images of the world can do a disservice to medieval maps, subordinating them to the modern biases of modern technology and its representations of space. *DM* is designed to facilitate interaction with these *mappae,* these documents, on their own terms, in ways that are fundamentally different. *Digital Mappaemundi*, aimed as it is at expanding our understanding of these historical documents and the cultures that produced them, must therefore be understood as a scholarly project more deeply rooted in the humanities than the sciences. Unlike other initiatives, *DM* does not seek to "correct" medieval maps by calibrating them to modern scientific measurements of physical reality, but rather, to embed them more fully within their original contexts for production and use by editing them with respect to a nexus of interrelated maps and the texts upon which they were based.

We aim to revolutionize and revitalize the field of early map study, a field largely marginalized in the past largely by the limitations of traditional print media and disciplinary boundaries. Work in the digital humanities has great potential to revive the study of these remarkable documents. As Jennifer Howard writes in regard to literary studies, the digital humanities are "the locus of some of the most energetic literary scholarship being done, its vitality putting the lie to claims that literary studies are moribund" ("Literary Geospaces," *The Chronicle Review,* August 1, 2008). The study of medieval maps likewise needs to be energized through the use of such technologies. As described below, we plan to design an interface that will allow users to search and link between not merely a series of texts but rather, a networked environment of texts and images and a process that allows for the easy digital editing and addition of materials. The sorts of searching and linking we propose are impossible in the print medium, and largely unrealized in its digital

counterpart. Still, computer science and digital technologies must invigorate studies in the humanities without imposing a modern scientific bias on pre-modern content, homogenizing thereby flattening its history and geography. Instead, technology should respond to the specific concerns of individual objects and periods.

Our program will uniquely serve to link the maps into a networked corpus in which they are connected to one another and to source and analogue texts. For anybody interested in studying *mappaemundi*, we hope to provide a tool by which new lines of inquiry may be discovered, previously unknown connections found, and innovative approaches to the material developed. These maps contain texts in Latin, written in medieval scripts that can be difficult to decipher without paleographical training; editing will therefore provide transcriptions and translations of all inscriptions. Similarly, the primary medieval source texts to be included are all written in Latin or Old English, and editing will also provide translations to enable students, scholars in related fields, and the general public to explore and study these maps. Finally, we hope that the open source architecture developed for *DM* will be to other fields seeking to expand access to similarly difficult materials. Our approach to design is use-inspired, rather than being based on a predetermined argument we wish to make through these documents, so in designing each feature of the program, we want to anticipate the needs and desires of a range of potential audiences.

Concomitant with our goal of accessibility is our dedication to the widest range of compatibility, based in cross-platform programming that is determinedly and robustly open-source. As argued in the *ACLS Report*, five characteristics are required for an "effective and trustworthy cyberinfrastructure for the humanities" -- that all digital projects should be accessible as a public good, be sustainable, provide interoperability, facilitate collaboration and support experimentation (27-29). The use of XML (extensible markup language) editing facilitates these goals, while the ultimately extensible nature of the program, which will be modular and collaborative. In turn, following the principles of Web 2.0 collaborative tagging, the project aims to allow scholars not only to use the program, but also to participate in its ongoing expansion and enhancement.

Open source models for digital projects such as *Digital Mappaemundi* can not only transform the degree and depth to which users can access and cross reference information found in documents they contain, but also transform the expectations and engagement of their users, moving them from passive consumers of information to active producers, as they initially chart new paths of meaning through these complex documents and, for some, come to participate in the XML editing and addition of new documents and data. *DM* is a resource of tremendous potential by no means limited to scholars with an immediate interest in its base texts. Under our extensible model, beyond this startup phase, the editing and network resource developed will serve as a basis for a much larger enterprise.

Environmental Scan

Numerous initiatives now apply digital technology to medieval cartographic study (for a broad sample see http://www.maphistory.info/projects.html), but most focus merely on providing digital scans of printed maps. Those that do more than present static images are largely concerned with geographical mapping (e.g. GIS) and/or rectification (e.g. the Bodleian Library's work with the medieval Gough Map or ADS's mapping of medieval Welsh towns – see below). Few such projects deal with early medieval content, and fewer still deal specifically with medieval *mappaemundi*. Still, more important than the subject matter of individual projects are the approaches and technologies applied to the materials. We have examined the extant digitizations of medieval maps currently available. These are generally small-scale projects focused on a single map. In the perhaps best-known example, Naomi Reed Klein has produced the CD-ROM *A Wheel of Memory: The Hereford Mappamundi* (2001). This partial digital edition of the most complex of the surviving *mappaemundi*, has, as one critics states, "an innovative organisation and high production values [that] are ultimately self-defeating. Despite its heavy reliance on a non-linear structural conceit, the edition itself is next to impossible to use or navigate in ways not anticipated by the project designers" (D. O'Donnell, "Using Technology to Guide Readers Through an Electronic Edition," *The Heroic Age*, Issue 8, June 2005). In contrast, the on-line *Die Ebstorfer Weldkarte: Ein Mittelalterliches Weltbild*, directed by Martin Warnke (http://weblab.uni-lueneburg.de/kulturinformatik/ projekte/ebskart/content/ start.html), is a relatively user-friendly

transcription of the Latin inscriptions, with German translation, of the Ebstorf Map. It is quite limited, though, in functionality, providing small, static details of sections of the map, each showing slightly more than one percent of the total surface of this very large work. It is not searchable, and does not provide links to other maps or texts, treating the work in absolute isolation. Very similar in approach (and limited to Windows platforms) the CD-ROM that accompanies Piero Falchetta, *Fra Mauro's World Map* (Turnhout: Brepols Publishers, 2006), designed by Caterina Balletti and Francesco Guerra, is a limited digital edition of this single work.

The interactive *Mapping the Realm* edition of the fourteenth-century Gough Map directed by Keith Lilley (http://www.qub.ac.uk/urban_mapping/gough_map/) is more advanced in its realization of the possibilities of digital technologies, providing a searchable interface that allows the user, as its introduction explains, "to identify the features that the map shows, such as towns and cites, roads and rivers, and study historical data relating to these places." Through the use of RDMS's ArdMS software package, the designers were able to provide layers highlighting geographic features. Innovative as this project is, though, it is essentially focused on connecting features of one map to features of the real world. It is the best of the currently available digital editions of a medieval map, but is still simply a digital edition of one map, in this case striving to connect the map to people, places and events that actually occurred on the sites it depicts. We aim, in contrast, to create a nexus of geographic texts and images linked not to the "real world," but to each other, to open up new investigations not only of individual works, but also of the connections between them, the worldviews of their creators, and the roles that they collectively played in shaping medieval cultures.

The usual approaches to historical geography and mapping are rapidly becoming synonymous with modern, measured, plotted and/or georectified spaces. For example, *Mapping Medieval Townscapes: A Digital Atlas of the New Towns of Edward I*, designed by K. Lilley, C. Lloyd and S. Trick (http://ads.ahds.ac.uk/catalogue/specColl/ atlas_ahrb_2005/index.cfm), creates a modern, accurate map on which medieval historical information and topography can be plotted. As such, it subordinates all content to current notions of geospatial representation and reality. Similarly, in John Unsworth's essay "Using Digital Primary Resources to Produce Scholarship in Print," he argues that "new possibilities for print scholarship are presented by born-digital information and the tools one uses with that information—to take just one example, consider geographic information systems … that map all kinds of social information onto geographic space" (http://www3.isrl.uiuc.edu/~unsworth/cyber-mla.2002/). Such projects and initiatives are most certainly valuable in their own right -- right here at Drew University, Louis Hamilton is developing a significant digital resource in his topographical mapping of Dante's Florence. But not all projects need "map" the study of the past onto a "real" and modern geographic space, but instead consider early materials on modern terms rather than on medieval ones. For digital projects (as for traditional textual projects) focused on historical material to be truly successful, they must sometimes grapple with material on its own terms, and acknowledge its particular concerns. *DM* works to create a leveled editing environment with works edited for their connections to other texts and objects, not ultimately subordinated to representational geography based on Enlightenment notions of observation-based science that do not reflect prevailing *medieval* understandings of the world.

History and Duration

In 2005 and 2006, we (Drs. Foys and Mittman) began to work on producing a digital edition of the Cotton Map (BL MS Cotton Tiberius B.V., f. 56v), completing basic research on the map and traveling to England to study the manuscript first hand. With research grants from Hood College, the NEH and the Institute for Humanities Research at ASU, we and our research assistants digitized and marked up this material. We then realized that the project had far greater potential and should be expanded. With our early work on XML editing and the integration of multiple schema under a prototype of the *Electronic Production and Presentation Technology* (EPPT) software that Kevin Kiernan and his team had developed (see http://beowulf.engl.uky.edu/~eft/eppt/) we had found a way to edit many texts in relation not only to a single map image, but multiple map images as well. Such editing could result in a relational database of all medieval maps and texts that could be continuously expanded in the future by other users.

Once other maps were edited, their coordinate-based XML tags could be used to cross-reference details within maps to their analogues on other maps, allowing for an innovative architecture and scale of comparative study. This epiphany served as the genesis of the *Digital Mappaemundi*.

DM then proceeded in two initial phases. In the summer of 2006, most of the XML markup of trial geographic texts (Isidore and Orosius) and the Cotton Map were completed. In the summer of 2007, the database and prototype began to be designed, and a second map, JCO 17 (St. John's College, Oxford, MS 17) was edited and tagged. Currently, plans are underway to digitally edit five other maps in conjunction with separate Andrew W. Mellon funded digitization initiatives at Stanford University and St. Gall (Switzerland). The next phase, at Drew University, involves an expanded team: Surekha Davies, Diarmuid Scully, and Robert E. Bjork, experts in the medieval content of *DM*, will assist in developing the database to include additional maps and texts. Shannon Bradshaw will now lead software design as we refine the database mapping and syntax, and develop the front-end web interface to allow users to study these materials in new modes. With NEH funding, we can complete this phase in the next year, culminating in a selective test launch of a prototype of the program online. Ultimately, *DM* will become an ongoing collaborative effort, and this startup grant would allow us to complete a full version suitable for public online launch and subsequent evaluation. The progress achieved through an NEH start-up grant will provide us with a fully functional prototype with which to seek larger sources of funding for the final phase of the project: transforming the current database of predetermined objects into a much larger, broadly collaborative extensible Web 2.0 database and public interface.

Staff (See **Section 6, Biographies**, for details.)
Martin Foys and Asa Simon Mittman will serve as co-Directors of the project. Shannon Bradshaw will direct the software development with consultation by Wei-Tek Tsai. Surekha Davies, Diarmuid Scully, and Robert E. Bjork will collaborate on the content of *DM*.

METHODS: Overview (See **Section 8, Attachments**: Appendix B, for details.)
DM will allow users to access specific maps or geographic texts, and study their content relationally, cross-referencing data (e.g. inscriptions, locations, or related material) to other edited maps and texts. New software also allows images to be easily edited with X-Y coordinates in XML tags, which means links generated from searches can be used to take users directly to specific locations on edited maps, as well as to correlate these locations to corresponding content in other edited maps and geographic texts.

METHODS: Functionality:
The planned user interface has been conceived in response to the findings of the *ACLS Report*, which argues that merely stockpiling data into databases is not sufficient:

> Users of these massive aggregations of text, image, video, sound, and metadata will want tools that support and enable discovery, visualization, and analysis of patterns; tools that facilitate collaboration; an infrastructure for authorship that supports remixing, recontextualization, and commentary—in sum, *tools that turn access into insight and interpretation* (p. 16).

DM contains a series of display areas, as depicted in the prototype screenshot in Section 8, Appendix A. This image is accompanied by a description of all of the features of the interface. The functionality of this project is perhaps best illustrated through example. A researcher working on Noah's Ark could enter this in the search tab (as shown, with the option to search all document types, as opposed to searching only maps, texts or secondary materials selected below) and among the results would be Jerome's *De Situ*, where we read *Si quidem in montibus Ararat arca post diluvium sedisse perhibetur: et dicuntur ibidem usque hodie eius permanere vestigiae* ("The ark is indeed regarded to have settled in the mountains of Ararat after the flood, and its vestiges are said to remain in that very place up to today.") With the linked passages underlined and highlighted in red, the user could click "arca" ("ark") and instantly be taken to this text and location on, for example, the Cotton Map, as shown in Appendix A.

A user might have taken any number of paths through the documents to arrive at this screenshot. For example, a user might have selected all four documents from the search results, but also might have

opened only one, and then linked from that to the other three, or from one to the next to the next. The user might begin with an image detail on the Cotton Map, link from this to the Latin Jerome text, then open the translation, and link from that to the JCO 17 Map, or alternately from the English translation of the Jerome to the Latin to the JCO 17 Map to the Cotton Map, and from there on to any number of other maps and texts in the database. The paths are not predetermined, but chosen by the user in the process of investigating these inherently transdisciplinary documents (It is worth noting that such dynamic searching is quite common in commercial uses of the Internet, but still almost unknown in scholarly editing).

Final Product, Dissemination, Evaluation, and Future Uses
Beginning with a web-based *beta* prototype, students and scholars can have access to high-resolution images of some of the most important medieval world maps as well as transcriptions and new translations of all of the geographical texts on which they were based (which would already make for a useful resource), in a mode that more fully exploits the possibilities of digital media, linking all of these documents to one another fluidly, so that users define their own paths of inquiry, rather than relying on a predetermined and limited set of connections drawn by traditional scholarship and editing.

Once we have conducted the trial launch, with the funding from a Digital Humanities Startup Grant, we will implement a three-stage period of evaluation. We will conduct an online survey of users, querying them on the choice of content, ease and intuitiveness of use of the interface, and usefulness of the supporting materials. We will also host a one-day workshop at Drew, inviting leading scholars in the digital humanities, bringing in scholars from outside the area to complement the active community of medieval scholars in and around New York City. In the workshop, participants will attempt a range of assigned tasks with the program and their progress will be recorded for further feedback. Following this, we will hold a roundtable to discuss functionality and content. This intense group evaluation should serve to identify the strengths and weaknesses of the project, so that improvements and updates can be planned. Following this workshop, in 2010 we will host a conference panel at the leading Medieval Studies conference, the International Congress at Western Michigan University in Kalamazoo, MI, and elsewhere as feasible. These panels will feature demonstrations, discussions of the history and development of the project, and examples of scholarship inspired by and based on use of the *Digital Mappaemundi*.

This innovative tool should be of use well beyond the scope of our current project. Not only do we hope to grow it under future funding to incorporate historical maps from across the globe, but we also hope scholars in other humanities fields will see the potential in this powerful, extensible tool for their own scholarship. Once completed and made available on the NEH's forthcoming Digital Tools website, the open source program could be downloaded and repurposed by scholars throughout the humanities and beyond. Such a platform could equally serve the study of cuneiform seals, Mayan manuscripts and glyphs, or Egyptian works in a wide range of media. These materials could be digitally edited in XML and, through our tool, linked in such a manner that, for example, a researcher interested in depictions of Osiris could rapidly identify images and texts referring to the deity on sarcophagi, tomb frescos, papyrus scrolls, and jewelry, and through further refinement of a search, could isolate themes of interest within these representations, (e.g. Osiris judging a soul). This technology would facilitate the creation of transdisciplinary interfaces, allowing researchers to identify new connections between disparate materials. The application of such an architecture is limited only by the creativity of those using it.

Work Plan
Currently, our most significant funding need is the refinement of our XML schema, completion of the database, and development of the front-end software application for *Digital Mappaemundi*. With institutional seed funding, we have established the bare bones of these systems which now need considerable expansion and modification. We need to employ a programming team of student assistants, who will finish the database architecture and develop the front-end GUI interface. With the aid of this team, we also need to refine the syntax and lexicon and functionality of our XML tagging and database mapping, based on feedback from the initial prototype. To further refine this work, we need to conduct evaluations of the project (see above: **Final Product, Dissemination, and Evaluation**).

Future Development

Major institutions have already shown an interest in this technology, most particularly the British Library and the libraries at Corpus Christi College, Cambridge and the St. Gall Monastery (Switzerland) – the latter two are digitizing their manuscript collections under grants from the Andrew W. Mellon Foundation, have asked us to test edit some of their medieval maps. Following this stage of the project, we plan to continue to expand the base of participating collections. We also have an agreement, pending project development, with *Iter: Gateway to the Middle Ages and Renaissance* (see http://www.itergateway.org/), which is an online digital library that includes a bibliography currently at 900,000 items, subscribed to by approximately 400 of the world's leading educational and research institutions. *Iter* is a non-profit partnership of the ACMRS and the University of Toronto, in association with the International Society of Anglo-Saxonists, Medieval Academy of America, Renaissance Society of America and Sixteenth-Century Studies Conference. *Iter* is willing to offer this site free of charge, in order that it be made available to the broadest audience. This distribution will place the *Digital Mappaemundi* on the map of medieval studies.

The *mappaemundi* project is the first step in the testing of this architecture, which places a series of texts and images on the same plane, not subordinating any to another. Following the work outlined above, the next planned phase of *DM* would greatly expand the project by increasing both the scale and scope of its coverage of data and the extensibility of the architecture. With proper funding, the potential of the technology of *DM* could in the future feasibly expand past *medieval content*, and the nature of the site could be transformed to accommodate historical maps from all periods and regions, to allow users to compare how geographic concepts change in an individual location—say, how Rome's view of its own location develops from Classical Antiquity through the Middle Ages, into the Early Modern period. *Digital Mappaemundi* therefore hopes to lay a foundation for a future resource that will become a tool not only useful to those interested in the European Middle Ages, but to the growing field of Comparative Humanities, facilitating transdisciplinary, transmedia approaches to maps that will drastically alter and improve how visual and textual materials are studied and used.

Such vast expansion of the project will require substantial funding, and we have identified an initial set of grants we will seek, including among others the NEH's Digital Humanities Initiative Challenge Grant, the NSF's Geography and Regional Science Program and the US Department of Education's Enhancing Education Through Technology Program, as well as the Getty Foundation's Critical Reference Resources Grant, the National Geographic Education Foundation Teacher Grants and the Royal Geographical Society Geography Grants.

With input from other collaborators, Drs. Mittman, Foys and Bradshaw will remain the core directors and collaborators of the project through this current phase and the next. But as the project grows we will expand participation, and once the architecture is fully established, our participation will to shift toward the editorial role of vetting the contributions of scholars to the *DM* dataset. In sum, our goal is nothing short of the revolutionizing of the field of Cartographic History. This will help to move the field toward a more conceptual approach, and therefore away from the scientifically based concern with the "accuracy" of historical maps—a concept that is irrelevant to the intentions and functions of most pre-modern mapping—thereby bringing discipline more fully into the Humanities.

Funding Level

We are seeking a Level II grant, as we have already laid much of the ground work for the thinking and technology of this project, developed a basic syntax for the editing of maps and texts, and created an early prototype of the resource. With Level II funding, we can create a comprehensive database of linked texts and images and refine our user interface, based on feedback from work-shopping the prototype.

6. Biographies

Martin Foys, Associate Professor of English and Communication Arts at Hood College and Visiting Associate Professor of English at Drew University (2008-2011), will serve as Co-Director of the project. He is an acknowledged leader in the field of digitization of medieval materials, and has extensive experience in the design and implementation of user interfaces. In his *Bayeux Tapestry Digital Edition* (Boydell/SDE: 2003, on CD-ROM), Foys designed and programmed the electronic architecture and wrote a comprehensive scholarly commentary for a new kind of scholarly edition. The *BTDE* was selected by *Choice* as a 2003 Outstanding Academic Title, and in 2005 won the International Society of Anglo-Saxonists Publication Prize for Best Edition. His current book, *Virtually Anglo-Saxon: Old Media, New Media, and Early Medieval Studies in the Late Age of Print* (University Press of Florida: 2007), a study in how print and then digital media affect the way we interpret medieval discourse, won the *ISAS* prize for Best Book (2005-2007), was awarded Honorable Mention in the *Modern Language Association's* Best First Book competition, and has been nominated for the Katherine Singer Kovacs Book Award for Cinema and Media Studies. Related publications also include "The Virtual Reality of the Anglo-Saxon *Mappamundi*," *Literature Compass* 1 (Blackwell, 2004): ME 016, 1-14 and "An Unfinished *Mappamundi* from Late Eleventh-Century Worcester: the Evidence for A Family of English Maps" for *Anglo-Saxon England*. In the past, Foys has advised digital projects for the Walters Art Museum (The Archimedes Palimpsest) and the Medieval Institute at Western Michigan University (Canterbury Cathedral prototype). Currently, he serves on the Medieval Academy of America's Committee on Electronic Resources (*CER*), is on the board of the International Society of Anglo-Saxonists, and is an advisor for ParkerWeb, a Mellon-funded project based at Stanford University, whose goal is the digitization of Cambridge University's Parker Library considerable collection of medieval manuscripts.

Asa Simon Mittman, Assistant Professor of Art History at California State University, Chico, is Co-Director of the project. He is a leading authority on medieval geography and, in particular, the images of exotic peoples at the edges of *mappaemundi*. His extensive research and publication on medieval world maps and related subjects is widely known, and he has been commissioned to write articles and reviews in the area of medieval geography for the *Oxford Handbook of Medieval Literature*, the *Oxford Dictionary of the Middle Ages*, and *Studies in Medieval & Renaissance History*. His work is widely used in university courses on the subject. Mittman's book on *Maps and Monsters in Medieval England* (Routledge: 2006) has been reissued in paperback due to strong demand and his second book dealing with medieval geography, *Inconceivable Beasts: The* Wonders of the East *in the* Beowulf *Manuscript* (co-authored with Susan Kim of Illinois State University) is forthcoming from ACMRS Press in 2008. His sessions on unnatural geography at the International Medieval Congress at the University of Leeds (2008) were chosen by both the International Center of Medieval Art and the Glasgow Centre for Medieval and Renaissance Studies for sponsorship. Mittman is also deeply committed to the use of innovative digital technologies in research and teaching. He has worked with the ParkerWeb project (and written "A Guide to Editions and Translations of the Chronica Maiora," *Parker on the Web*, http://parkerweb.stanford.edu/ 2004), designed several fully online courses, helped art history departments at three universities transition from traditional 35mm slides to digital images, and he routinely gives workshops for graduate students on the use and manipulation of digital images for teaching and research. Mittman is prepared to dedicate the majority of the research component of his position to this phase of the project, and will be free to conduct the necessary travel. With Martin Foys, he will oversee all matters pertaining to the project, particularly coordinating efforts by research assistants, photographers and programmers. He will also continue to conduct primary research on the maps included in the project in order to provide more complete and accurate background information about them, and about their contents.

Shannon Bradshaw, Associate Professor of Computer Science at Drew University, will head up the technical implementation of the next stage of *DM*. Shannon is an expert in human interaction with

information. His recent work has focused on information sharing and collaborative research environments and he has published many frequently cited papers in this area. He has been invited to lecture at the Thomson Corporation, Goldman Sachs, and a number of conferences and colloquia at US and European universities. In addition to traditional scholarship, Shannon has consulted on topics of social networking and information management with a number of companies (both for- and non-profit). Currently, Shannon is managing a team of developers in designing and building the information infrastructure for a small hedge fund. He is also a principle in the startup company, Jamseed.com, a music-oriented marketplace that uses crowdfunding to help musicians meet their career objectives. This project will be of significant benefit to Shannon in particular and computer science at Drew University in general. It opens a number of publication avenues for Shannon to continue ongoing work in group information management and collaborative annotation. Publication venues will include the ACM Multimedia, Intelligent User Interfaces, World Wide Web, and Hypertext conferences as well as a number of information science journals. Drew's computer science students will benefit from the opportunity to develop large-scale multi-tiered software systems in collaboration with faculty and students in other disciplines. This will provide both the depth and breadth of experience targeted by Drew's praxis-oriented liberal arts computing curriculum.

Surekha Davies, Tutor in Early Modern History at Birkbeck, University of London and a doctoral candidate at the Warburg Institute, University of London, will serve as a member of the design team and as our primary cartographic advisor. She expects to submit her dissertation in October 2008, on "Representations of Amerindians on European Maps and the Construction of Ethnographic Knowledge, 1506-1624," freeing her to participate extensively in the development of *DM*. Her dissertation is an ambitious comparative, interdisciplinary study of how distinctive depictions of Amerindians emerged on manuscript and printed maps. These images and textual descriptions varied across centers of cartographic production and regions of America, and demonstrate how maps did not merely reflect the ethnography of travel accounts, but also transformed it. The project has involved tracing the classical and medieval antecedents of ethnographic thought, such as the writings of Pliny, Aristotle and Isidore of Seville. The monstrous peoples on medieval *mappaemundi* resurfaced in the New World on sixteenth-century maps. From 2000-2006, Davies was a Curator in the Map Collection at the British Library. Her duties included research for exhibits, catalogues and potential auction purchases; running seminars and talks for students and visitors; cataloguing pre-1850 acquisitions, selecting history of cartography literature for purchase; providing scholarly expertise to other map collections; and giving conference papers on the history of cartography. These activities covered maps from the medieval period to the present day, but focused on the period before 1650.

Diarmuid Scully, Lecturer of History at University College, Cork, is an expert on the Hereford Map, by far the most complex and detailed map to survive from the Middle Ages, and he will focus on the identification of its source texts and analogues and then on the tagging of the map. His research has recently turned to highly specific analysis of the significance of individual geographic features and toponyms, an approach that has not been adequately applied to the Hereford Map in the past. He has written several articles about medieval geography and cultural identity, including "What is My Nation? Constructions of Irish Identity from Medieval to Modern*"* in *Orbis Hiberniae: Views of Ireland and the Irish in Antiquity* and "Reform and Renewal: Ireland and Europe in the Twelfth Century." Dr. Scully is currently completing a book on *The Atlantic Archipelago from Antiquity to Bede: the Transformation of an Image*, a text that deals at length with the Hereford Map. With over one thousand inscriptions, this map is sufficiently complex that the tagging of it for inclusion in *DM* will constitute a substantial effort and this will be Dr. Scully's central role in the project.

Robert E. Bjork, Professor of English, Director of ACMRS, and Director and General Editor of *Medieval and Renaissance Texts and Studies* at ASU, has been General Editor of *Arizona Studies in the*

Middle Ages and Renaissance (Brepols) since 1995 and is the General Editor of the forthcoming *Oxford Dictionary of the Middle Ages*. He has published four books on Old English poetry. In 2001, he was elected to the prestigious Council of the Medieval Academy of America and is a Corresponding Fellow of the English Association and past president of the International Society of Anglo-Saxonists. He was elected a member of the Institute for Advanced Study, Princeton, for 2004-5, and was awarded an NEH Senior Fellowship for 2006-7. Dr. Bjork is helping with dissemination through his position at the ACMRS and his position on the Executive Board of *Iter*. As an excellent linguist, for this phase of the project he will serve as a senior advisor on the editing of texts and translations for the project, and insure that our new translations will help form new standards for scholarly research.

Wei-Tek Tsai, Professor of Computer Science and Engineering at ASU, headed the team that developed the first iteration of the database architecture for *DM*. Wei-Tek will continue to consult on aspects of the database and user-interface. Digital mapping has been an important research topic in computer science for more than twenty years, and it has been used extensive in navigation systems today. Tsai's research focuses on SOA research, including Web service, XML, PSML-S model, data provenance, ontology, and collaboration. He has published extensively on related topics, and has served as an editor for several journals including IEEE Transactions on Knowledge and Data Engineering.

Prior Collaborators
In addition to this core of collaborators, we have benefited from the assistance of other scholars. **Kevin Kiernan** and his team have assisted greatly in the development of the EPPT software; this relationship was reciprocal, as *Digital Mappaemundi* team served as beta-testers for the program. **Scott Westrem**, a noted authority on medieval maps and the Hereford Map in particular, was an important collaborator in the earliest phase of this project and plans to rejoin the project when he finishes with his current research.

Institutional Support
This is a deeply international and collaborative project. In addition to our home institutions, we currently have the enthusiastic support of the British Library, obtained on a research trip to England in July, 2006, and the expressed interest of the Parker Library at the University of Cambridge. Currently we are using maps from the Parker Library in consultation with the ParkerWeb project, a Mellon Foundation initiative housed at Stanford University, and this work has laid the foundation for a future partnership, pending funding.

APPENDICES

APPENDIX A: GUI prototype screenshot
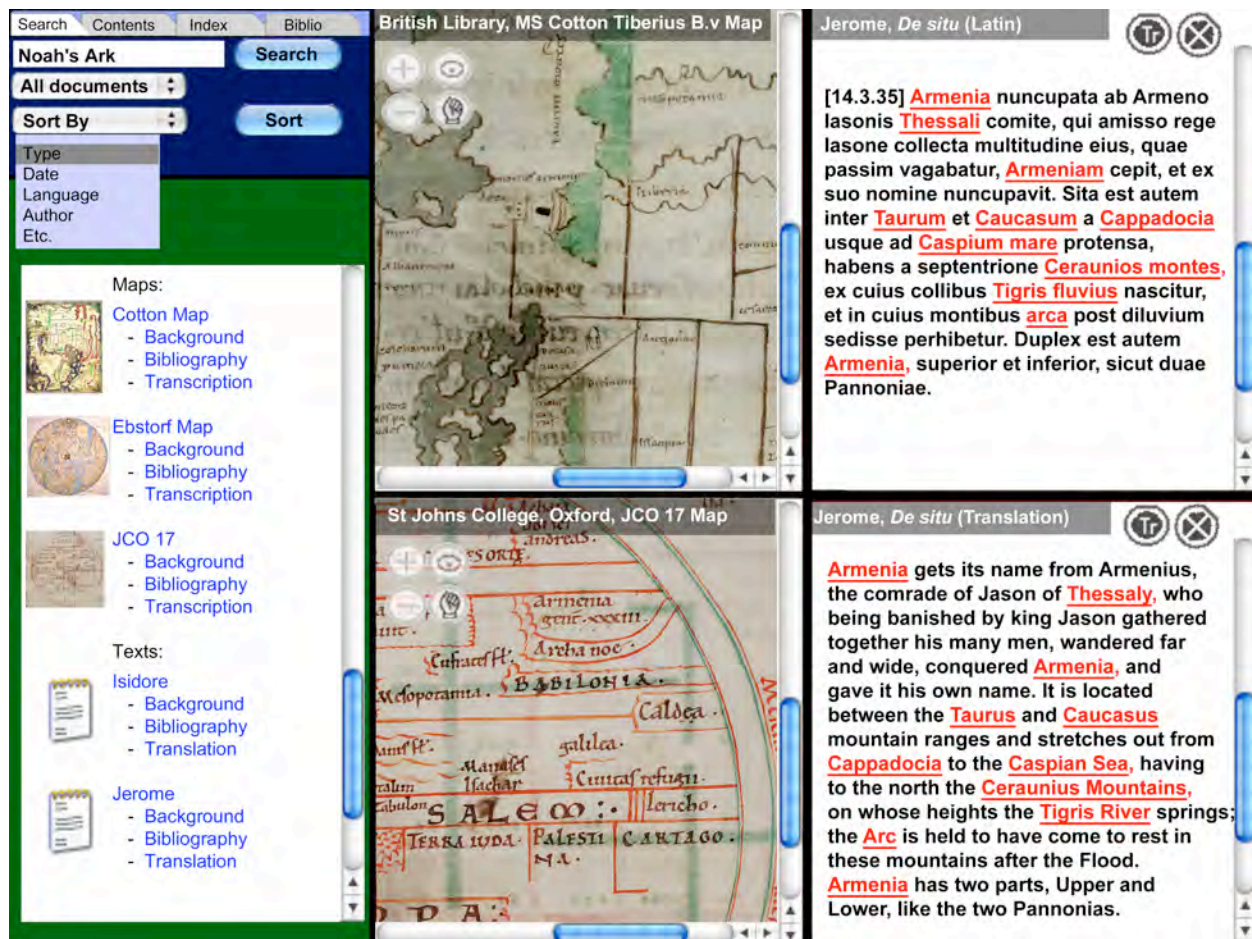
Description of GUI prototype scheme

      The left frame contains four tabs, thereby allowing for a large amount of information in a limited space. The **Search** tab (shown selected here) is the basis for much of the functionality of the program. It allows the user to query the database for any terms or keywords that appear in any of the maps or texts, and to choose what types of documents will be included in the results (i.e. texts, maps, secondary supporting materials). These can then be sorted by frequency, date, provenance, result type (map or text), or original language. The list of results presents small thumbnail icons of the maps (and a generic icon for all the texts), with basic information and links to more detailed information as well as to the documents, themselves, which can be viewed in the frame to the right. Up to four documents can be simultaneously viewed here in frames-within-frames, as the larger frame dynamically splits into two, three, or four sub-frames, as additional documents are opened. The number, size and position of these frames can be adjusted as necessary.

      The **Contents** tab contains a full list of all of the documents in the database, with their basic information and links to detailed information and the document. The Contents list, like a set of search results, can be sorted by document name, date, provenance, type or language. The **Index** tab contains a full list of keywords—standardized reference terms for specific details or aspects of maps and texts—used in the database, so that users may look up chosen spellings (medieval spelling is highly variable, e.g. the name of one "monstrous race" might be spelled "blemmye," "blemme," "blemmyae," and "blemee"—

when editing maps or texts, occurrences of this race are then tagged to the standard keyword) and thereby find what terms will lead to successful searches across all variations. Finally, the **Bibliography** tab contains an ever-growing searchable list of secondary sources on the subject, to be updated by the project collaborators and eventually by users. In a future phase of this project, items, when possible, will be linked to electronic versions available from other online resources.

If an image is opened, the user has access to a standard set of navigational tools (e.g. pan and zoom), but the program also allows the user to select any inscription or visual detail (e.g. cities, bodies of water, peoples, animals, monsters, landmarks and depictions of historical events) on the map, and link from this not only to a transcription and translation, but to the appearance of this feature on any other maps and within any texts in the database. Such cross-referencing cannot happen in traditional modes of study, and provides users the ability to swiftly identify connections and correspondences between these documents, thereby gaining a rich understanding of the role geographical texts played in the construction of medieval *mappaemundi* and also of the manner in which content of the maps relate to one another. If a text is opened in the right frame, all tagged passages can be highlighted. Clicking on these presents the user with the same set of options. These links allow for a completely fluid association of texts and images that, instead of functioning as static documents, become incorporated within a complex nexus of interactive information. In traditional print sources, associations between works are by necessity linear in nature, which does not accurately represent the process of reading and interpreting images. Instead, in digital form, a researcher can proceed according to the dictates of the maps themselves.

While this user interface is still in the alpha prototype phase, it nonetheless indicates much of the intended functionality. It shows in the left frame the search results, including Jerome's *De Situ* and the Cotton and JCO 17 Maps. The right portion of the screen is divided into four sub-frames, as if the user has already opened four documents. In the upper left frame, we see a detail of the Cotton Map, zoomed in on "Arca noe" ("Noah's Ark," with an accompanying image). Below this is the same detail on the JCO 17 Map. To the right, above we have Jerome's Latin text, and below this we see a translation into English. Clicking on the inscription or image on either map gives the user the option of viewing this same location on the other maps or in other texts.

Function buttons appear on the texts and images. In the image frames, the buttons bearing plus and minus signs are for zooming in and out. The Eye button puts the program in rollover mode, in which the user can mouse over map details, tagged in XML, so that the content (i.e. inscription, translation, notes) will appear in a pop-up box. This feature toggles with the Hand button, which instead allows the user to grab and drag the image. In the text frames, the "**Tr**" button allows (through AJAX protocol) each section of a text to be interspersed with its original or modern English form (depending on the current display). The "**X**" Button highlights all cross-referenced passages tagged in XML (as shown underlined and in red here).

APPENDIX B: Methods Overview

The development and success of XML as a protocol for digitally tagging texts has created the opportunity to design an application capable of searching not only digitally edited texts but also map images for particular content. The search result can then be assembled and presented dynamically in response to specific scholarly inquiry. In addition to simply presenting edited maps and texts for individual study, *DM* will allow users to access specific maps or geographic texts, and study their content relationally, cross referencing data (e.g. a given inscription, location, or related material) to other edited maps and texts. Recently developed software also allows images to be easily edited with x-y coordinates in XML tags, which means links generated from searches can be used to take users directly to specific locations on edited maps, as well as to correlate these locations to corresponding content in other edited maps and geographic texts.

Using software such as *Electronic Production and Presentation Technology* (EPPT: see http://beowulf.engl.uky.edu/~eft/eppt/) one can now edit and tag maps and texts by designing XML *schema* that contain a series of secondary attributes that can be assigned values specific to textual or geographic content. These edited materials in turn form the basis for a dynamic database engine, created

with Data Manipulation Language (*DML*—see below), that will parse and present shared values of maps and texts, allowing easy comparative analysis and exploration of any number or combination of maps and texts. All of this functionality, rooted in the edited data, will be accessible through an intuitive front-end user interface.

The completion of and experimentation with the database and the development of the front-end software application for *Digital Mappaemundi* are the most important steps that now need funding. To date, all the work for *Digital Mappaemundi* has focused on the editing of maps and texts to newly implemented XML standards—creating, in effect, the framework of a database that will continue to grow and develop—as well as on developing the first form of the database mapping and syntax that will enable the project's functionality. But this database is useless without a user-friendly gateway to study and search its content. To achieve the project's goal of broad-based public access, the end-user application also needs to be compatible with standard web browsers on multiple platforms. It should allow users, in addition to the basic browsing and navigation of texts and maps, to search and cross-reference specific content in both maps and texts, to generate sets of dynamic search results and indices that allow the user to easily assemble, manage and study this content directly at the level of individual details. Such a resource will provide flexible modes of study not possible in traditional print scholarship of medieval maps (or indeed, in most aspects of contemporary Medieval Studies and the History of Cartography). Additionally, this interface is to be designed *predicatively*, that is, able to accommodate the continuous addition of new maps and texts that will be edited to the *Digital Mappaemundi* XML standards. Finally, the architecture we are developing will be extensible in the broadest sense, able to eventually incorporate a much larger Web 2.0 based structure for augmentation and expansion by scholars other than its developers. This final version, to be eventually made available online on the NEH's forthcoming Digital Tools website, should serve as the basis for future projects linking texts and images, as described below (p. 15). For a detailed description of the planned software architecture, see Appendix A (p. 19).

APPENDIX C: Data Manipulation Language (*DML*) Architecture Design

The project will be technically supported by Dr. Bradshaw's group in the Drew University Department of Mathematics and Computer Science, building upon previous work done by Dr. Tsai's group at Arizona State University. Dr. Bradshaw's group focuses on SOA research, which includes Web service, XML, PSML-S model, data provenance, ontology, and collaboration. As shown in Fig. 1, *DML* project works as follows: Users interact with the web interface; the Server receives input from users, processes users' request, fetches information from the database, creates responses, and sends new views to users; the Database holds information regarding the encoded texts and images; and EPPT assists in the initial encoding of texts and images, producing XML files for integration into the database.

DML project follows MVC (Model-View-Controller) architecture. MVC is an architectural pattern used mainly in web-application development, which serves to separate data (model) and user interface (view) concerns, so that changes to the user interface will not affect data handling, and so that the data can be reorganized without changing the user interface. MVC enforces the separation between
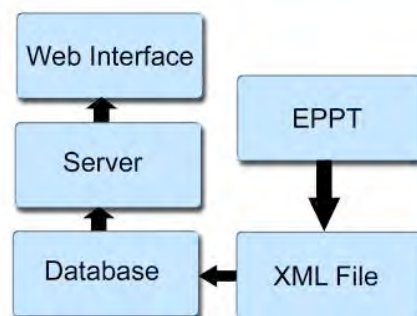

Figure 1: DML Overview

the input, processing, and output of an application. To this end, an application is divided into three core

components: model, view, and controller. Each of these components handles a discreet set of tasks. In MVC, the Model represents enterprise data and business rules. The Controller interprets requests from the user, handles requests, updates models, and calls relevant views. Views are the web pages, which provide users responses and results according to models. By decoupling models and views, MVC helps to reduce the complexity in architectural design while increasing flexibility.
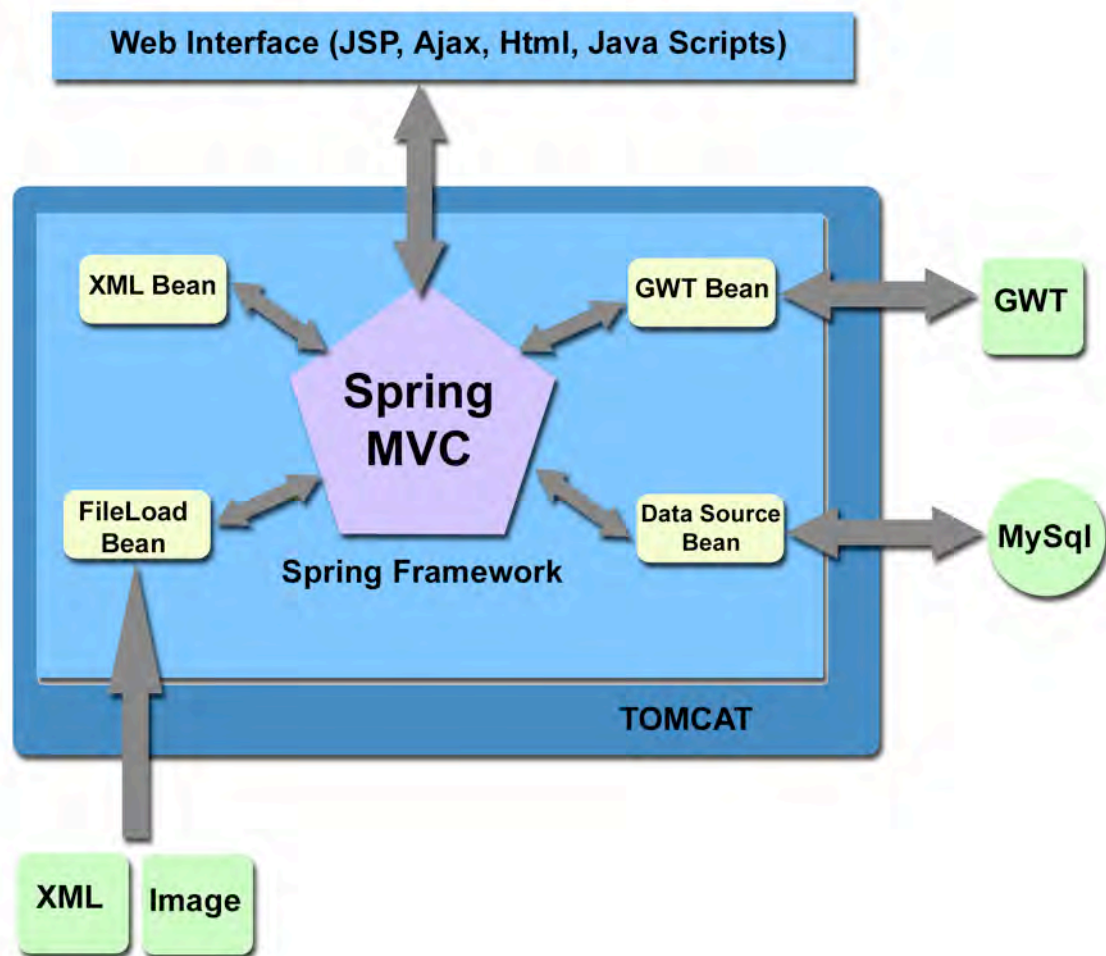
The overall process has the following workflow (See Fig. 2): Users interact with the web pages by submitting requests and receiving responses. Once users submit requests, based on their properties, the Front Controller dispatches those incoming requests to relevant controllers to handle the requests. Specific controllers execute their business logics and update business models. In addition, controllers inform the Front Controller which views should be rendered to users. Combined with updated models, dynamical views are displayed.
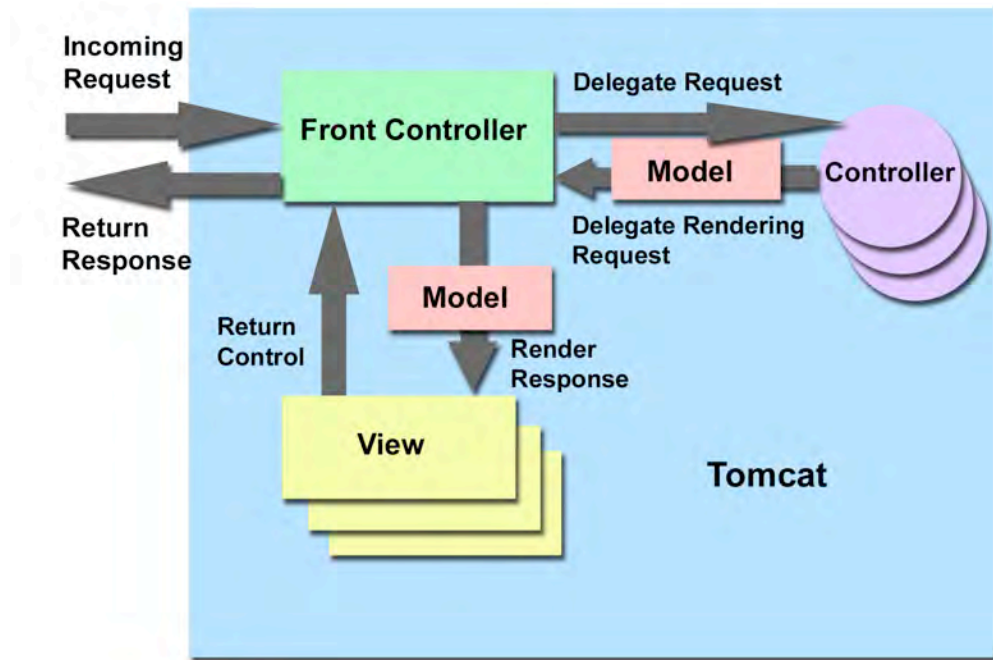
Figure 2: DML Workflow

In order to implement such a web-based system, *DML* project will rely on a combination of widely accepted open source application frameworks and technologies, as shown in Fig. 3. The whole design and development process follows a dominant Object-Oriented standard. As described above, MVC has been selected as the underlying architecture. We are using Java SDK 1.4.2 as programming platform, while adopting Java Servlet and JavaServer Pages as web development technologies. These have all been developed and distributed by Sun (http://java.sun.com/j2se/1.4.2/). Sun, however, does not provide a development environment for developing Java applications. In order to support development and facilitate debugging, we are using Eclipse IDE for Java Developers as the Java Integrated Development Environment (IDE) (http://www.eclipse.org/downloads/).

For the database component of *DML* project, we have adopted MySql Community Server 5.0, as this is a reliable open source database server. In order to connect the database to the Java environment, a Java Database Connectivity (JDBC) driver is required. We have chosen Mysql-Connector-Java- 5.0.7 to align with the MySql database Server (http://dev.mysql.com/downloads/mysql/5.0.html).

Web Interface (JSP, Ajax, Html, Java Scripts)

XML Bean

GWT Bean

GWT

Spring
MVC

Spring Framework

FileLoad
Bean

Data Source
Bean

MySql

TOMCAT

XML   Image

DML project is expected to run as a web application, and therefore needs a web-server to host it. We have selected Apache Jakarta Tomcat 5.0 as the Servlet/JSP container. Tomcat version 5 implements the Servlet 2.4 and JavaServer Pages 2.0 specifications from the Java Community *DML* Process, and includes many additional features that make it a useful platform for developing and deploying web applications and web services (http://tomcat.apache.org/). In addition to the web-server, we have included Spring framework as our web development framework. Spring framework is a leading open-source Java/J2EE framework. It gives full support for implementing MVC easily, organizing the whole development process conveniently, and managing all servlets or JavaBeans well (http://www.springframework.org/).

DML project is designed to handle significant user interaction, including complex image operations. In order to increase *DML*'s interactivity, we are using the Ajax technique. Ajax is a web development technique used for creating interactive web applications. The intent is to make web pages feel more responsive, thereby increasing the web page's interactivity, speed, functionality, and usability. We are using the Google Web Toolkit to support Ajax development. Google Web Toolkit is an open source Java software development framework that makes writing Ajax applications easy for developers (http://code.google.com/webtoolkit/). JSP is another java technology that we apply in creating web interfaces. JavaServer Pages (JSP) is a Java technology that allows software developers to dynamically

generate HTML, XML or other types of documents in response to a web client request. The technology allows Java code and certain pre-defined actions to be embedded into static content.

In addition, *DML* project is supported by several packages. We are utilizing the Application Programming Interface (API) from Commons-fileupload-1.2, which is an open source package provided by Apache Commons Project (http://commons.apache.org/fileupload/). By using Commons-fileupload-1.2, we are able to provide a robust file upload service for users. *DML* also needs fetch information from encoded XML files. We have adopted the dom4j 1.6.1 package as the XML parser. Dom4j is an open source library for working with XML, XPath and XSLT on the Java platform using the Java Collections Framework and with full support for DOM, SAX and JAXP (http://www.dom4j.org/). Besides Eclipse IDE and the standard Java compiling engine, we are using Apache Ant 1.6.5 as for the Java build and to deploy tools. (http://ant.apache.org/). Apache Ant makes building, deploying, and testing easier by enabling XML-based file configuration.

In conclusion, the architecture of *DML* project has several benefits. The widely acceptable frameworks selected enable flexibility and facilitated expansion of the project. The open source frameworks can be integrated with various techniques and plug-ins to simplify project creation, maintenance and validation. The MVC separates the presentation layer from the business layer. Hence, it separates the concerns of a GUI design and the logic behind its implementation. Each layer can be maintained separately without impacting others. The combination of Ajax and JSP technologies enables more interactivity between *DML* and users by increasing responsiveness, creating dynamic web views, and improving functionality. Finally, the open-source packages and tools confer many valuable properties into the project development and deployment, such as robust service, bug-free code, convenient software modules, and easy debugging, development and testing.